REPORT DOCUMENTATION PAGE

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
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4. TITLE AND SUBTITLE

Assessing the hemodynamic effects of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in traumatic cardiac arrest when closed chest compressions are augmented by directing the area of maximal compression over the left ventricle in a swine model (sus scrofa)

5a. CONTRACT NUMBER

5b. GRANT NUMBER

FWH20140094A

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

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5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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8. PERFORMING ORGANIZATION REPORT NUMBER

FWH20140094A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

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10. SPONSOR/MONITOR'S ACRONYM(S)

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12. DISTRIBUTION/AVAILABILITY STATEMENT

Distribution A. Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Evidence shows that LVCC during TCPA improve hemodynamics and ROSC compared to standardCC.REBOA improves hemodynamics and controls hemorrhage during TCPA.Hypothesis:REBOA and LVCC improve hemodynamics and ROSC in swine. TTE used to mark the AR and LV on animals(n=52) which were randomized to CC in one of two areas.Half the animals in each group had REBOA.30% hemorrhage and VF induced to simulate TCA.After 10min of VF,BLS initiated for 10mins,ACLSw/blood transfusion for 10 more mins.REBOA balloon inflated at BLS min6.ROSC increased in standardCC w/REBOA(33%)compared to standardCC w/out REBOA(0.0%)($p=0.04$).In standardCC animals, aortic SBP, right atrial SBP and ETCO2 increased during BLS($p<0.005$) w/REBOA.ETCO2 increased during BLS in LVCC w/REBOA compared to LVCC w/out REBOA($p=0.0001$).ROSC and other hemodynamics no significant difference.No difference in ROSC or hemodynamics between the LVCC and standardCC w/REBOA. In our model of TCPA, ROSC and hemodynamics improved in standardCC arm.No additional benefit with REBOA in LVCC.

15. SUBJECT TERMS

swine, hemorrhage, resuscitation, BLS, ACLS, REBOA, traumatic cardiac arrest, chest compressions

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Jeffrey Morgan, MD
U	U	U	SAR		19b. TELEPHONE NUMBER *(Include area code)* 502-468-3872

WHASC – Animal Final Report

18May16

1. **Protocol Number: FWH200140094A**

2. **Type of Research:** Animal Research

3. **Title:** Assessing the hemodynamic effects of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in traumatic cardiac arrest when closed chest compressions are augmented by directing the area of maximal compression over the left ventricle in a swine model (sus scrofa)

4. **Principal Investigator (PI):**

Name	Rank	Date of IACUC Training	Branch of Service / Corps	Staff Resident Fellow Civilian	Department / Office Symbol	Email (if other than WHASC Outlook)	Phone	Pager
Jeffrey Morgan	O-3	July 2014	USAF	Fellow	959 IPTS	jdm224@hotmail.com	WP: 916-0808 FAX: 292-7649	

5. **Purpose:** The primary objective was to assess whether the increase in return of spontaneous circulation (ROSC) and short-term survival (to 60 minutes), when performing chest compressions (CC) directly over the left ventricle, are maintained if REBOA is added to the resuscitation protocol.

Secondary outcomes included additional indicators for quality of CPR including hemodynamic variables (aortic systolic and diastolic blood pressure, right atrial systolic and diastolic blood pressure, coronary perfusion pressure, mean arterial blood pressure, end-tidal carbon dioxide), laboratory variables (pH, lactate, base excess, nitric oxide (NO), and near-infrared spectroscopy (NIRS) for measuring cerebral perfusion.

6. **Results**:
ROSC increased among standard CC animals with REBOA (33%) compared to standard CC animals without REBOA (0.0%) (p=0.04). Among standard CC animals, aortic systolic blood pressure, right atrial systolic blood pressure and end tidal CO2 (ETCO2) increased during all time intervals of BLS (p<0.005) with REBOA. ETCO2 also increased during BLS among LV CC animals with REBOA compared to LV CC animals without REBOA (p=0.0001), however, ROSC and other hemodynamics were not significantly different. There was no difference in ROSC or hemodynamics between the LV CC and standard CC groups with REBOA.

7. **How may your findings benefit the Air Force?**
Survival of military traumatic cardiopulmonary arrest (TCPA) victims is low, but remains higher than survival in the civilian population. Small but incremental improvements in CPR could dramatically increase the survival rate. Our group has demonstrated that LV CCs improve ROSC and short-term survival in an animal model of TCPA. REBOA has been shown by other investigators to improve hemodynamics in hemorrhagic shock. Our group has now shown that REBOA improves hemodynamics, ROSC and short-term survival when added to standard chest compressions in an animal model of TCPA. The addition of REBOA also shows a trend toward improved ROSC and short-term survival in LV CC animals. Our study was adequately powered, based on preliminary estimates of an effect size of 0.57 and an expected mortality of 75%. The current study yielded mortality rates of 70% and 40% for the ROSC and LV groups respectively. Post hoc power based on our sample size was computed to determine that an expected effect size of 0.62(arcsine transformation used) is needed to achieve 80% power to detect a significant difference. Although a statistically significant difference was not determined in this study, the trend of increased survival definitely warrants further study. These results suggest that LV CCs may significantly increase

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Copy to Budget? Yes No BIRDS Agenda Who Signed? PI Co-PI Auth AI

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the survival of military TCPA patients, REBOA may increase survival if standard CCs are used instead. Human studies are now needed to translate our animal findings to human outcomes.

8. Number of Animals

Projected Enrollment of Animals at the Beginning of Study: 36

Actual Number of Animals Enrolled: 35

9. Status of Animals Entered Into the Protocol: The animals entered into the study were in general good health. All animals were euthanized at the end of the study per protocol.

10. Status of Funds: Our study was funded by the AF SGR. We had no budget deviations and all funds have been allocated for.

11. Reason for Closure: Objectives of the study were met

12. Specific Problems: The study went well; we did not encounter any specific problems.

13. Publications and Presentations:

Presentations:
Lightning oral presentation at American Heart Association (AHA) Scientific Sessions, Orlando, FL, November 2015

These Presentations and Publications have been cleared by 59 CRD and Public Affairs.

Publications:

The manuscript is being prepared and has not yet been published.

These Presentations and Publications have/have not (choose one) been cleared by 59 CRD and Public Affairs. (Do not delete this sentence.)

14. Exceptional Achievements: None

15. Signature of Principal Investigator:

_____

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PROCESSING OF PROFESSIONAL PUBLICATIONS/PRESENTATIONS

TO: CLINICAL RESEARCH SQUADRON/MSR	FROM: (Name/Office symbol)	PROTOCOL NUMBER:

1. TITLE OF MATERIAL TO BE PUBLISHED OR PRESENTED

2. MATERIAL IS FOR *(please check the appropriate box or boxes)* (ATTACH COPY OF MATERIAL TO BE PUBLISHED/PRESENTED)

☐	PUBLICATION/JOURNAL *(List intended publication/journal)*
☐	PUBLISHED ABSTRACT *(List intended journal)*
☐	BOOK CHAPTER OR BOOK *(Indicate intended publisher, name, city, country)*
☐	POSTER *(To be demonstrated at meeting / Name of Meeting, City, State, and Date of Meeting)*
☐	PLATFORM PRESENTATION *(At civilian institutions / Name of Meeting, City, State and Date of Meeting)*
☐	OTHER *(Describe; Name of Meeting, City, State and Date of Meeting)*

POINT OF CONTACT

3. WHO IS THE PRIMARY POINT OF CONTACT AT WHASC? *(Last, First, M.I.)*	DUTY PHONE/PAGER No.

AUTHORSHIP AND CO-AUTHORS(S) *(List in the order they will appear)*

LAST NAME, FIRST NAME AND MIDDLE INITIAL	GRADE/RANK	SQUADRON/GROUP/OFFICE SYMBOL	INSTITUTION*(If not 59 MDW)*
a.			
b.			
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COMMANDER'S SIGNATURE	DATE

1ST INDORSEMENT

TO: CLINICAL RESEARCH SQUADRON/MSR	1. DATE IN	2. ASSIGNED FILE NUMBER
3. DATE REVIEWED		

4. AUTHOR CONTACTED FOR RECOMMENDED OR NECESSARY CHANGES	☐	YES *(If yes, give date)*	☐	NO

5. COMMENTS

☐ APPROVED

SIGNATURE AND TITLE OF REVIEWER	DATE

2ND INDORSEMENT

TO: OFFICE OF PUBLIC AFFAIRS (PA)	1. DATE IN	2. DATE OUT

3. COMMENTS

☐ APPROVED *(In compliance with security and policy review directives)*

SIGNATURE AND TITLE OF REVIEWER	DATE

3RD INDORSEMENT

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2. SENIOR AUTHOR NOTIFIED BY PHONE OF APPROVAL	☐	YES	☐	NO	☐	COULD NOT BE REACHED	☐	LEFT MESSAGE

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